

# Two-sided Matching for Navy Enlisted Detailing: Deferred Acceptance vs. Linear Programming

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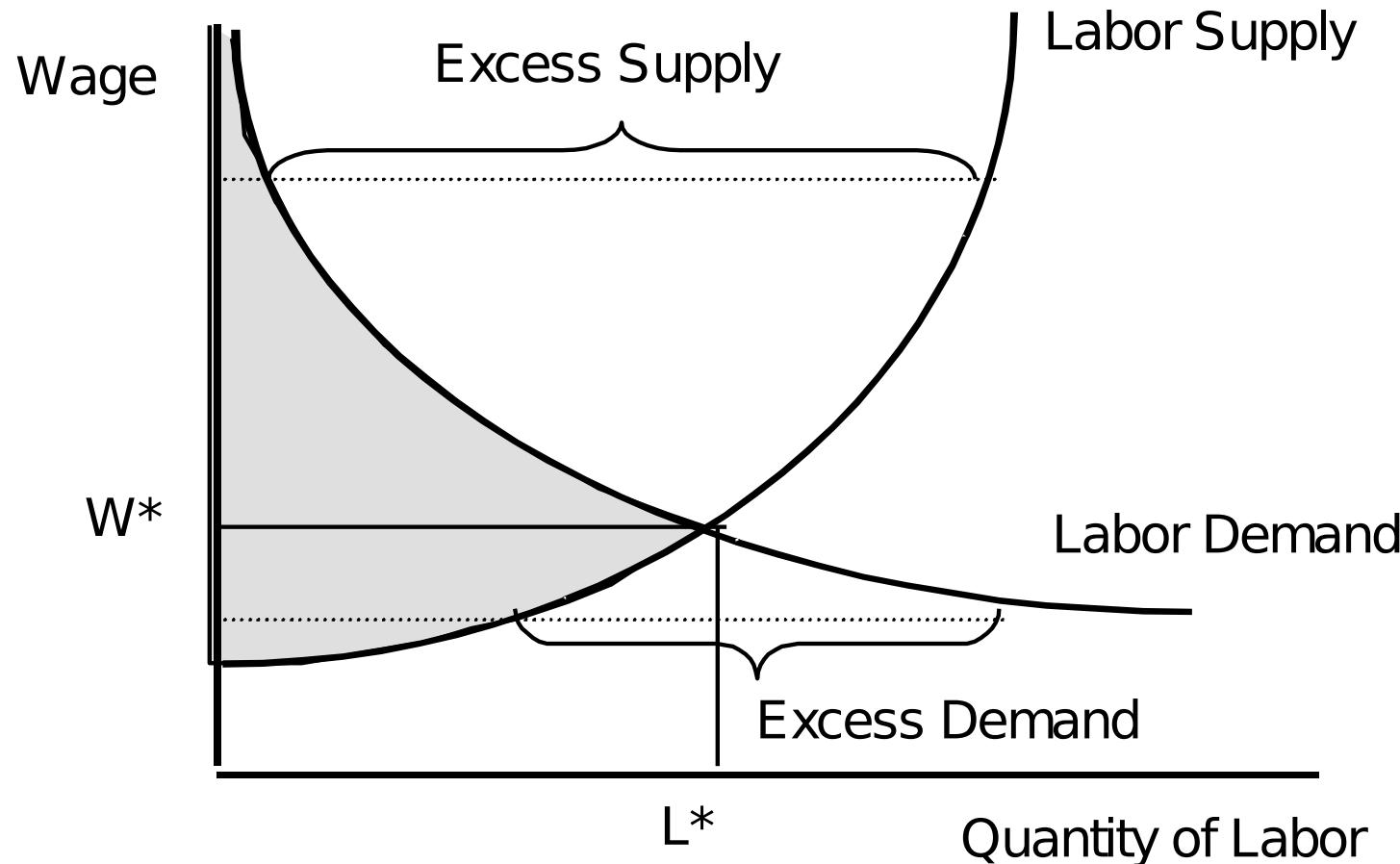
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# Research Questions

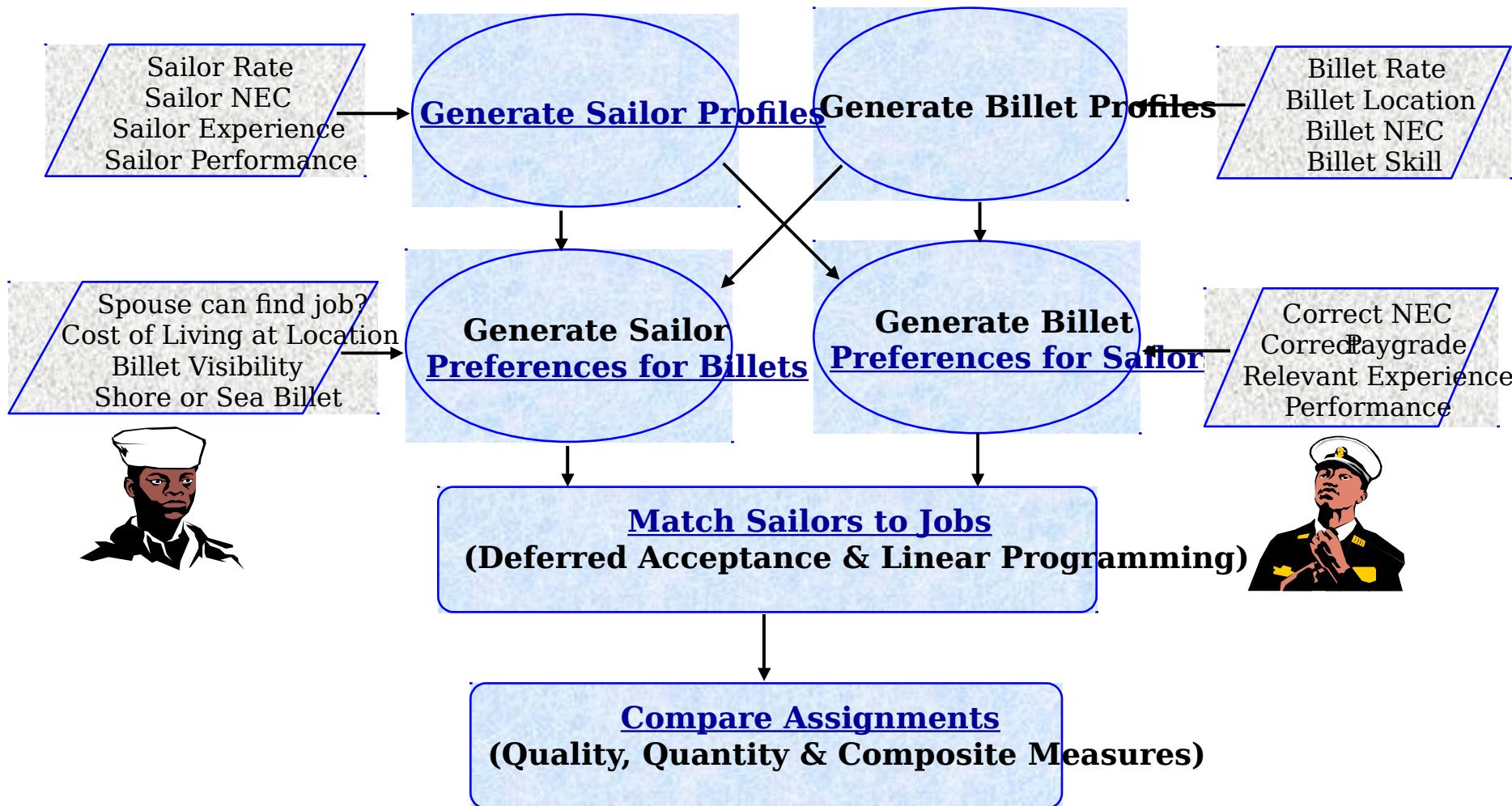
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- What do we mean by a good fit between a sailor and a command?
  - Quantity
  - Quality
- What is the relative performance of the LP and the DA matching algorithm when applied to the U.S. Navy's enlisted assignment process?
- Sponsor: NPRST - PERS 1

# Labor Markets



# Navy Enlisted Detailing Simulation Model: NEDSim



# Optimization

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- Maximize quality of fit (minimize quasi-prices)
  - Minimize sailor/command rank-order-preferences (ROP)
  - Maximize sailor/command utility
  - Use weighted average ROP/utility
    - ◊  $0.5U_S + 0.5U_C$

# Two-sided Matching

## Example:

### Sailor-Bias

**Sailor #1** **Sailor #2** **Sailor #3** **Sailor #4** **Sailor #5**

6	6	2	6	6
3	3	5	8	8
4	4	7	3	3
8	8	3	4	4
2	2	4	1	2
5	5	6	2	5

**Comd #1** **Comd #2** **Comd #3** **Comd #4** **Comd #5** **Comd #6** **Comd #7** **Comd #8**

2	2	2	2	2	4	2	2
5	5	5	5	5	2	4	1
1	1	1	1	4	3	1	4
4	4	4	4	3	1	3	3
3	3	3	3	3	5	5	5

Sailor 1	Sailor 2	Sailor 3	Sailor 4	Sailor 5
—6—	—6—	—2—	6	—6—
—3—	3	7		8
4				

# *Evaluation Criteria*

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- Quantity measure
  - ❖ Percentage Matching 
- Quality measure
  - ❖ Percentage Average Utility 
  - ❖ Percentage Unstable Matches 

# ***Findings: Priority 1 Billets***

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	<b>Sailors</b>		<b>Commands</b>	
	<b>DA</b>	<b>LP</b>	<b>DA</b>	<b>LP</b>
<b>Percent Matched</b>	<b>17.7%*</b>	<b>19.8%*</b>	<b>88.2%*</b>	<b>98.8%*</b>
<b>Percent Average Utility</b>	<b>66.8%</b>	<b>68.7%</b>	<b>73.6%*</b>	<b>78.2%*</b>
<b>Percent Unstable</b>	<b>0.0%</b>	<b>22.0%</b>	<b>0.0%</b>	<b>22.0%</b>

**\*Significant at the 95% level**

# *Findings: Priority 2 Billets*

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	<b>Sailors</b>		<b>Commands</b>	
	<b>DA</b>	<b>LP</b>	<b>DA</b>	<b>LP</b>
<b>Percent Matched</b>	<b>19.5%*</b>	<b>35.7%*</b>	<b>14.2%*</b>	<b>25.9%*</b>
<b>Percent Average Utility</b>	<b>85.1%</b>	<b>84.6%</b>	<b>67.3%*</b>	<b>38.7%*</b>
<b>Percent Unstable</b>	<b>0.0%</b>	<b>0.7%</b>	<b>0.0%</b>	<b>0.7%</b>

**\*Significant at the 95% level**

# Findings

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- **More Robust Simulation**
  - Actual sailor and billet profiles
  - Actual sailor and command preference factors
- **Multiple Criteria for Success Defined**
  - Quantity Measure - Percent matched
  - Quality Measures - Average Utility, Percent Stable
- **Optimal algorithm depends on Navy's tradeoff between the quantity and quality performance measures**
  - Likely restricted to sailor rank order lists